States (NJ)
1989-10

FHWA/NJ-89-010
89-010-7660

Correction of Rutting Using Wheelpath Inlays

Construction Report

by

Robert F. Baker
Principal Engineer, Research

and
John M. Salt, Jr.
Principal Engineering Aide

Principal Investigators:
John J. Quinn, Project Engineer, Research
Louis Sansone, Project Engineer, Maintenance

June 1988

New Jersey Department of Transportation

Division of Research and Demonstration

Bureau of Transportation Structures Research

Prepared for the U.S. Department of Transportation,
Federal Highway Administration

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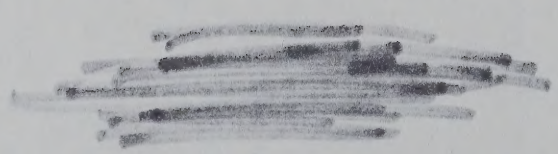

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1. Report No.	2. Government Accession No.	
FHWA/NJ-89-010-7660		

4. Title and Subtitle	5. Report Date
Correction of Rutting Using Wheelpath Inlays	July, 1987
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Robert F. Baker and John M. Salt, Jr.	89-010-7660
9. Performing Organization Name and Address Division of Research and Demonstration New Jersey Department of Transportation 1035 Parkway Avenue Trenton, NJ 08625	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. NJ HPR Study 7766
12. Sponsoring Agency Name and Address New Jersey Department of Transportation 1035 Parkway Avenue Trenton, NJ 08625	13. Type of Report and Period Covered Construction Report
	14. Sponsoring Agency Code

15. Supplementary Notes

Prepared in cooperation with the Federal Highway Administration, U.S. Department of Transportation, Washington, D.C.

16. Abstract

This report documents the construction phase of the study, "Correction of Rutting Using Wheelpath Inlays". A final report will be prepared at the conclusion of the four-year study.

The objective of this research study is to develop a less-costly procedure for correcting wheelpath rutting. The procedure discussed in this construction report involves the use of an inlay placed in the wheelpaths using equipment similar to a slurry seal machine. The inlay is proposed as an alternate to the current, more-costly practice of milling and overlaying. The material used for the inlay is a latex-modified asphalt emulsion with the trade name "Ralumac".

Two Ralumac inlay projects were constructed in 1984 and 1986 on a 2.2 mile southbound section and a 1.9 mile northbound section of Route I-295, Westville, N.J. The 1984 inlay was not part of this project.

Rut depth, Mays roughness, and skid resistance data were taken before and after construction. The after construction rut depth data and Mays roughness are fair, and skid resistance is good. Data will be taken twice a year during the study.

The inlay procedure has an approximate $2.00 per square yard initial cost advantage over the standard method of milling and overlaying. However, the net (life cycle) cost of the inlay will be determined at the end of the study.

The inlay appears to offer an effective, alternate, less-costly procedure for correcting wheelpath rutting. Recommendations are presented for further use of the inlay at stopping areas to determine the effect on skid resistance.

17. Key Words	18. Distribution Statement
Highway Maintenance Rut Filling	Copies available on request.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	35	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Table of Contents

		Page
	Abstract	iii
	Summary and Conclusions	1
	Recommendations	3
1.0	Introduction	4
	1.1 Objective	4
	1.2 Background	4
2.0	Scope	5
	2.1 Description of Test Site	5
	2.2 Method of Evaluation	7
3.0	Materials	7
4.0	Construction	9
	4.1 Data	15
	4.2 Construction Problems	20
	4.3 Costs	20
	APPENDIX A - Mix Design Sheet	A-1
	APPENDIX B - Cold Laid Latex Modified Emulsion Pavement Courses	B-1
	APPENDIX C - Report of Analysis of Aggregate	C-1

Page

Figures

Figure 1 - Test Location of Ralumac 6

Figure 2 - Construction Layout 10

Figure 3 - Estimated PSR-Mays Relationship 18

Figure 4 - Estimated Relationship between PSR and Pavement "Acceptability" 19

Tables

Table 1 - Mix Design Properties 8

Table 2 - Rut Depths, Skid Resistances, Mays Data 16

Photos

Photo #1 - Bergkamp Mobile Mix Paver 11

Photo #2 - Six Foot Spreader Box 11

Photo #3 - Rut Filling Operation .....-..... 13

Photo #4 - Inlay Immediately after Paving 13

Photo #5 - Finished Inlay 14

Summary and Conclusions

This report documents the construction phase of the study, "Correction of Rutting Using Wheelpath Inlays". A final report will be prepared at the conclusion of the four-year study.

The objective of this research study is to develop an alternate, less-costly procedure for correcting wheelpath rutting. The procedure which is discussed in this construction report involves use of an inlay placed in the wheelpath using equipment similar to a slurry seal machine. The inlay is proposed as an alternate to the current, more-costly practice of milling and overlaying. The material used for the inlay is a latex-modified asphalt emulsion with the trade name "Ralumac".

Ralumac was constructed under contract with United Slurry Seal of New Jersey and Bituminous Paving Systems of Ohio on Route I-295, Westville. In October 1984 the initial inlay, which was not part of this project, was constructed in both rutted wheelpaths in the southbound lanes. Since the initial construction successfully and economically corrected the severe rutting of the existing bituminous pavement, a second rut filling application was begun on May 6, 1986 in the northbound lanes. A full width overlay of Ralumac was constructed on the initial southbound inlay. The construction was completed on May 12, 1986.

The construction procedure entails the use of a self-propelled mixer which proportions and mixes the aggregates, latex-modified asphalt emulsion and water, and discharges the mixture into a spreader box which is pulled behind the mixer. A six-foot spreader box was used to fill ruts.

The aggregate was a trap rock from Mt. Holly Asphalt, Devault Plant. The asphalt emulsion was a cationic Type CSS-1H from PACO Products Inc., Reading, Pennsylvania.

No major problems affected the quality of construction.

Rut depth measurements prior to inlaying indicated that existing ruts averaged one inch in depth. After rut filling, rut depths were 0.16 inches. In December, the rut depths increased to 0.27 inches which is attributed to consolidation of the inlay under traffic. Rut depth measurements will be made twice a year.

The average skid resistance values of the mainline pavement increased by 43% and 53% for the northbound and southbound lanes respectively. The present skid resistance values are good. Skid resistance will also be measured twice a year during the evaluation. Since this project had no stopping areas, skid data was not available for those areas.

The initial average PSR values of 2.37 and 2.15 for the Ralumac are low for new pavement. May's meter and PSR data will continue to be measured on a twice yearly schedule.

The total in-place cost of the rut filling is $3.16 per square yard. This compares favorably with the approximate $5.00 per square yard cost of milling and overlaying.

Based on the successful initial inlay construction and the construction data of the May 1986 second project, the inlay procedure appears to be an effective, alternate, less costly procedure for correcting wheelpath rutting. The Ralumac inlay fills wheel ruts quickly by eliminating major construction delays and provides good skid resistance for mainline pavement.

Recommendations

Based on the initial satisfactory performance of Ralumac as a maintenance rut filling process, it is recommended that additional sections of Ralumac be constructed as appropriate sites become available. The use of Ralumac solely as an anti-skid treatment was not considered to be one of the primary objectives of this study. Its use in many of the areas subject to rutting, i.e., stopping areas at traffic signals, would require a high degree of skid resistance. Although the skid resistance properties to date appear satisfactory, additional rut filling installations at stopping areas would provide further evidence. Future sites could be selected with this requirement.

1.0 Introduction

1.1 Objective

The objective of this research is to develop an alternate, less costly procedure for correcting wheelpath rutting. The procedure involves use of an inlay placed in the wheelpaths using equipment similar to a slurry seal machine. This inlay would be an alternative to the current procedure of milling and overlaying. The material used for the inlay, is a latex modified asphalt emulsion with the trade name of "Ralumac". This report describes the installation and early performance of this material.

1.2. Background

Wheelpath rutting of bituminous surfacing resulting from heavy wheel loadings can necessitate premature pavement overlays. Poor drainage in the rutted wheelpaths is one of the primary causes of hydroplaning and skidding accidents. Ponded water in ruts also contributes to water seepage through cracks and joints thus accelerating pavement deterioration. To correct this rutting, expensive measures such as the use of a leveling course or milling often must be undertaken prior to resurfacing.

The Ralumac cold applied paving system is a mixture of latex modified asphalt emulsion, high quality aggregate, type I portland cement, water and an additive to accelerate breaking and curing. This product was developed in West Germany by Raschig GmbH, of Ludwigshafer - Rhein. It reportedly has been widely used to fill wheel ruts on autobahns and main highways in Western Europe.

In October 1984, the inlay was constructed on Route I-295, Westville, in both wheelpaths of the southbound, outside and center lanes from M.P. 24.6 to M.P. 26.0. Two problems were encountered during construction: (1) traffic control at ramps which lead to tracking across the inlay, and (2) coarse stone deposits at the edge of the ruts which did not allow a neat "feathering" of the inlay. In the subsequent installation of Ralumac, the problem of controlling traffic in the vicinity of the ramps was solved by leaving short unpaved sections for cross-over traffic. These short sections were paved after the adjacent Ralumac was cured sufficiently to support traffic. The problem of the feathering was solved by using a finer graded mix.

For the initial installation, the aggregate was a trap rock from Warner Co., Dyer's Quarry, Birdsboro, Penna. The asphalt emulsion was a Cationic Type CSS-1H from PACO Product's Inc. Reading, Penna. (See Appendix A).

Because of the success of the initial inlay installation, a second installation of the inlay was initiated and is described herein.

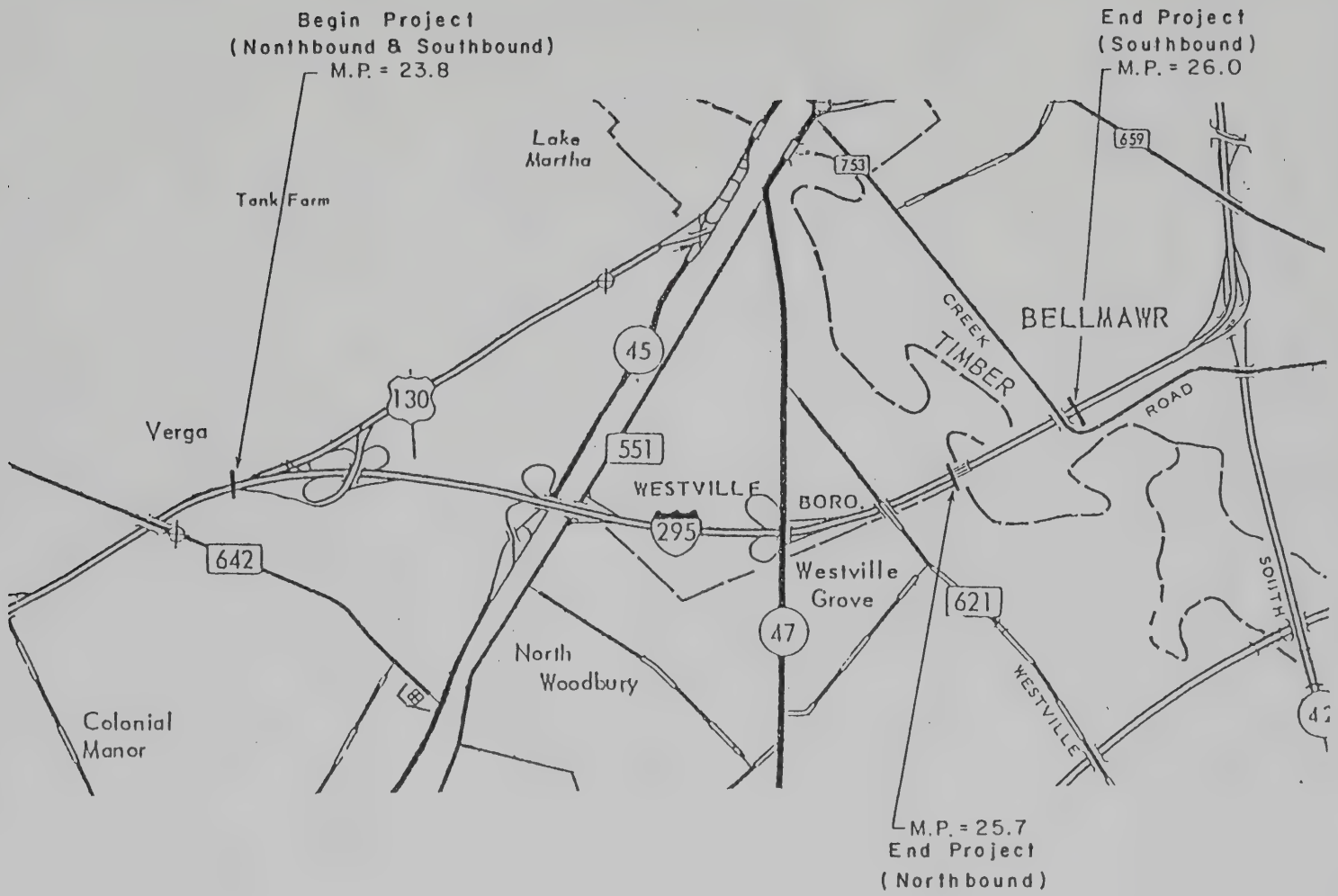
2.0 Scope

2.1 Description of Test Site

The Ralumac test site is located on Route I-295, Westville, Gloucester and Camden Counties, and is shown in Figure 1. This section of Route I-295 is an urban six lane divided bituminous concrete pavement. The 1984 AADT (Average Annual Daily Traffic) is 41,900 at the intersection of Route N.J. 45 and 55,200 at the intersection of Route N.J. 47. Several years prior to the construction of Ralumac, the original bituminous concrete pavement was

Figure

TEST SITE OF INLAY PROJECT
GLOUCESTER & CAMDEN COUNTIES



overlayed with a variable thickness bituminous concrete. Severe rutting was noted on the entire section.

2.2 Method of Evaluation

During the four year Ralumac study, annual condition surveys, semi-annual rut depth measurements, skid resistance and roughness surveys will be documented and monitored by Research with the assistance of the Bureau of Maintenance.

3.0 Materials

The Ralumac mix design was formulated by the supplier in accordance with the Bureau of Maintenance specification "Cold Laid Latex Modified Emulsion Pavement Courses" in Appendix B. The mix gradations and sources of aggregate are shown in Table 1. The NJDOT Laboratory Report of Analysis of aggregate and miscellaneous materials is shown in Appendix C.

Ralumac is a mixture of aggregate, latex modified asphalt emulsion, type I Portland cement, water and an additive. The Ralumac additive controls the breaking and curing time of the mix. The material cures from the bottom-up through a chemical reaction that releases water to the surface.

Because the breaking and curing are chemically triggered, the aggregate must be compatible with the latex modified emulsion. The chemical reaction, which is indicated by a change from a pH 2 (acidic) in the pug mill to a pH of 10 (basic) behind the spreader box, provides the

Table 1

Mix Design Properties

Gradation

Screen Size	Ralumac Type B (Percent)
1/2"	100
3/8"	95-100
#4	65-85
#8	45-65
#16	28-45
#30	19-34
#50	12-20
#200	5-12

	Type B (Percent)
Asphalt Emulsion	5.5-7.0
Mineral Filler (Type 1 cement)	2.0±.5
Latex Base Modifier	2.0-4.0
Water	As Required

Marshall Stability maximum 1800
Marshall Flow minimum 6 to 16

Source of Materials

Ralumac Type B

Aggregate :	Mt. Holly Asphalt - Devault Quarry, trap rock
Cement:	Allentown Cement Co.
Emulsion:	PACO Products, Inc. Reading, Pennsylvania Type CSS-1H
Water:	Local supply

quick set. For that reason, a trap rock aggregate from Mt. Holly, Devault Quarry was used instead of the more skid resistant blast furnace slag. A cationic (positive charge) type CSS-1H latex modified emulsion was used on the Route I-295 project.

4.0 Construction

The general contractor for the Ralumac construction was United Slurry Seal of Wenonah, N.J., and the subcontractor was Bituminous Paving Systems of Hilliard, Ohio. Ralumac construction began May 6, 1986 by filling both wheel ruts in the southbound center and outside lanes from M.P. 23.8 to 24.6. The southbound inside, center, and outside lanes were overlayed with a full width application from M.P. 24.6 to 26.0.

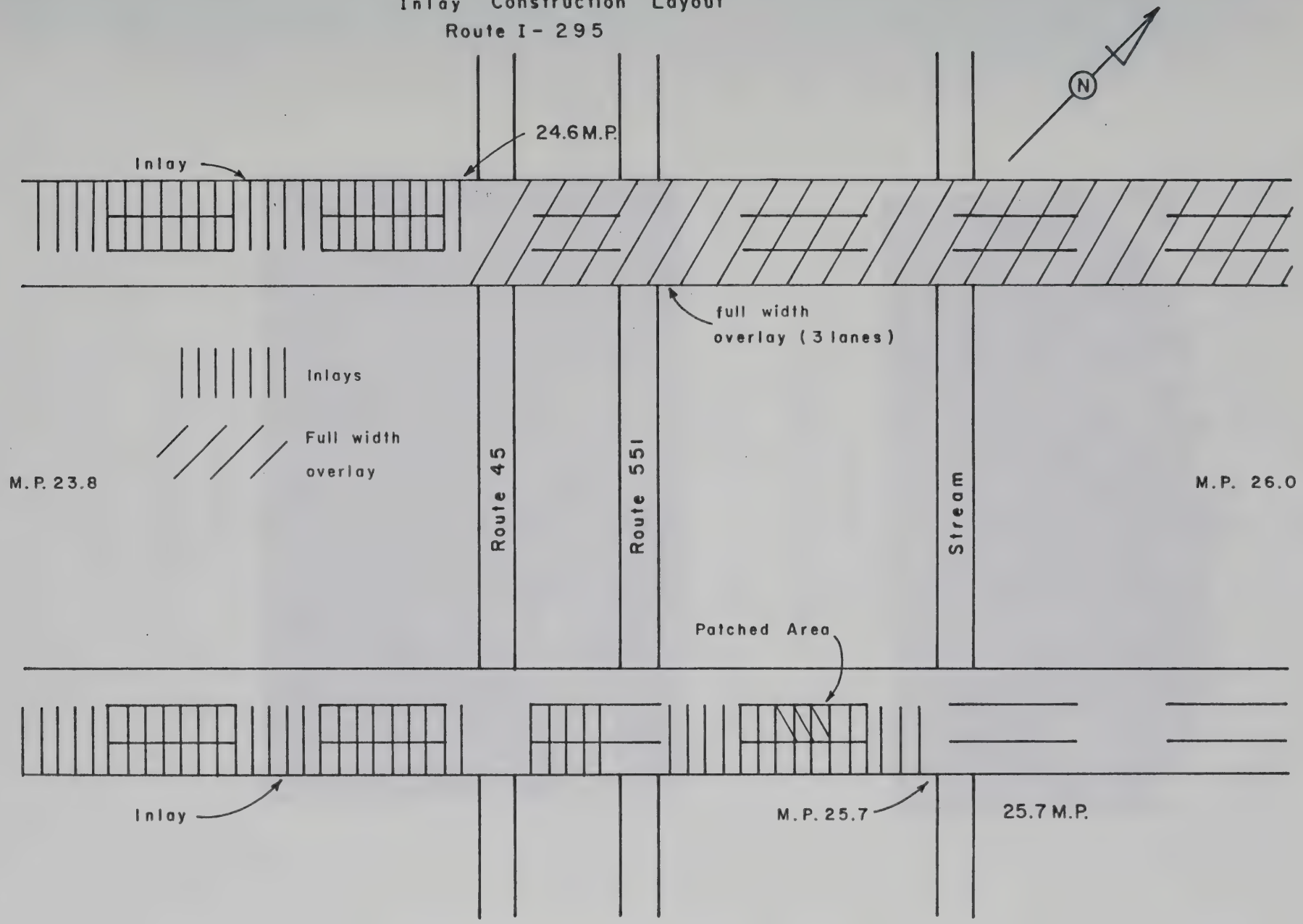
In the northbound direction, an inlay was constructed in both wheelpaths in the outside and center lanes from M.P. 23.8 to M.P. 25.7. No full width overlay was constructed in the northbound lanes. An area of about 600 feet was repaved with the inlay in the center lane at M.P. 25.6 to correct gouges. The Ralumac construction was completed on May 12, 1986. A layout of the construction is shown in Figure 2.

The construction process uses a self-propelled mixer (Bergkamp Mobile Mix Paver) which proportions and mixes the aggregate, latex modified asphalt emulsion type 1 Portland cement and water, and discharges the mixture into a spreader box which is pulled behind the mixer. The self-propelled mixer is shown in Photo #1. The aggregate, latex modified emulsion and water are discharged from a specially build hopper truck into the self-propelled mixer. From the mixer, Ralumac is discharged into the spreader box Because Ralumac is thixotropic, it requires mechanical agitation during placement. The spreader box is equipped with auger

Figure 2

Inlay Construction Layout

Route I - 295



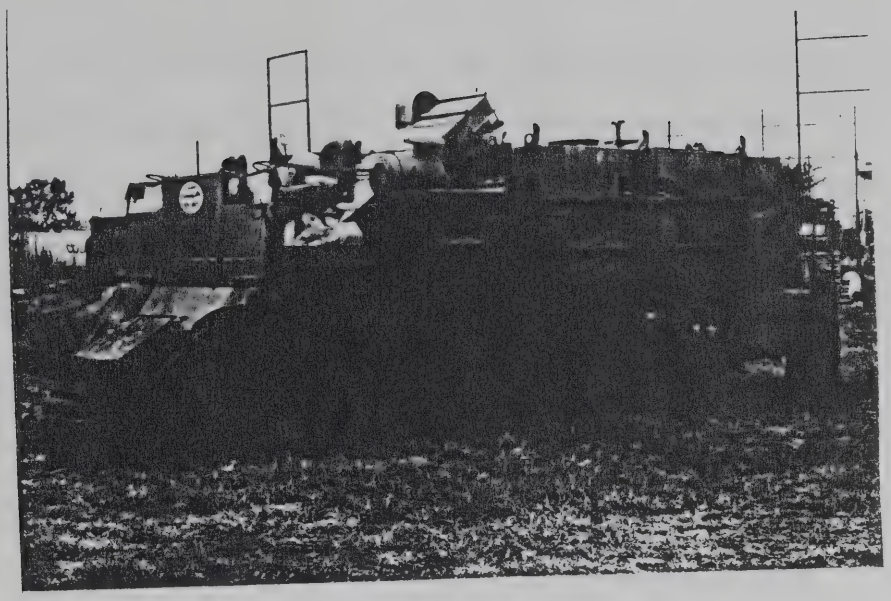


Photo #1

Bergkamp Mobile Mix Paver

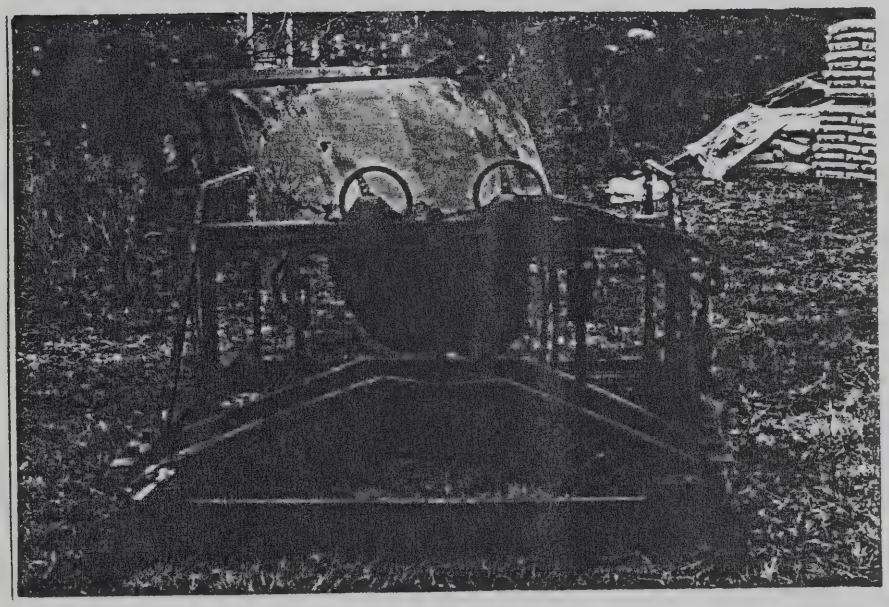
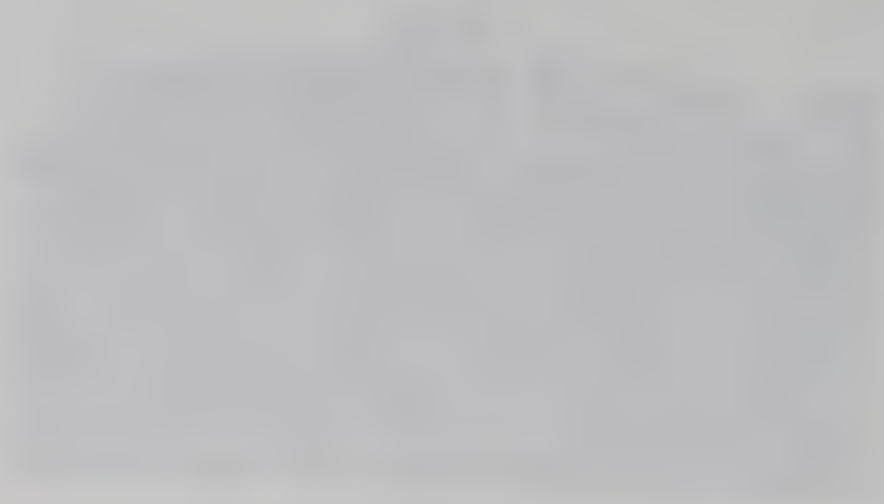
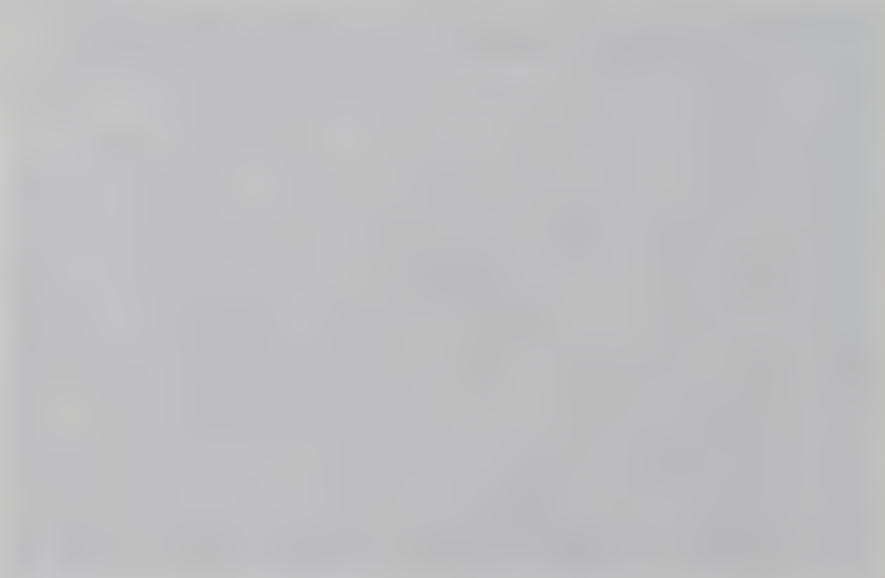


Photo #2

Six foot Spreader Box





paddles that move the material from the center to the ends along the rear squeegee that brings the material back to the center along the front of the box. The auger paddles create a uniform material distribution throughout the box, and create the required agitation to prevent the material from breaking and curing in the box.

The wheelpath rut filling used a six foot spreader box which is shown in Photo #2. This specially designed box has two metal screeds with rubber inserts that are angled from the sides toward the center. Augers are used ahead of the first strike off plate to uniformly spread the mix. The pavement surface was dampened by a fine spray mist at the front of the spreader box. The rut filling operation is shown in Photo #3.

After the inlay was paved, two men walked along the sides of the rut filling with rubber screeds to distribute the inlay material over the surface. The surface was then rolled with a pneumatic tired roller; the Ralumac is rolled immediately behind the paver. Photo #4 shows the inlay immediately after paving. Notice the wet appearance. The roller operator used his discretion on the number of roller passes. Photo #5 shows the inlay after opening to traffic.

The average application rate was 226 tons per day for rut filling and 136 Tons per day for overlaying. A total of 1,302 Tons was applied in both directions.

The formulator (Rasching GmbH) of Ralumac recommends that the material should be constructed when the air temperature is above 40°F and there is no chance of freezing temperatures for 24 hours after placement.

The pavement was opened to traffic from 1/2 hour to 6 hours depending on weather conditions, curing and traffic. Essentially, curing time was dependent on air temperature and was based on the judgement of the

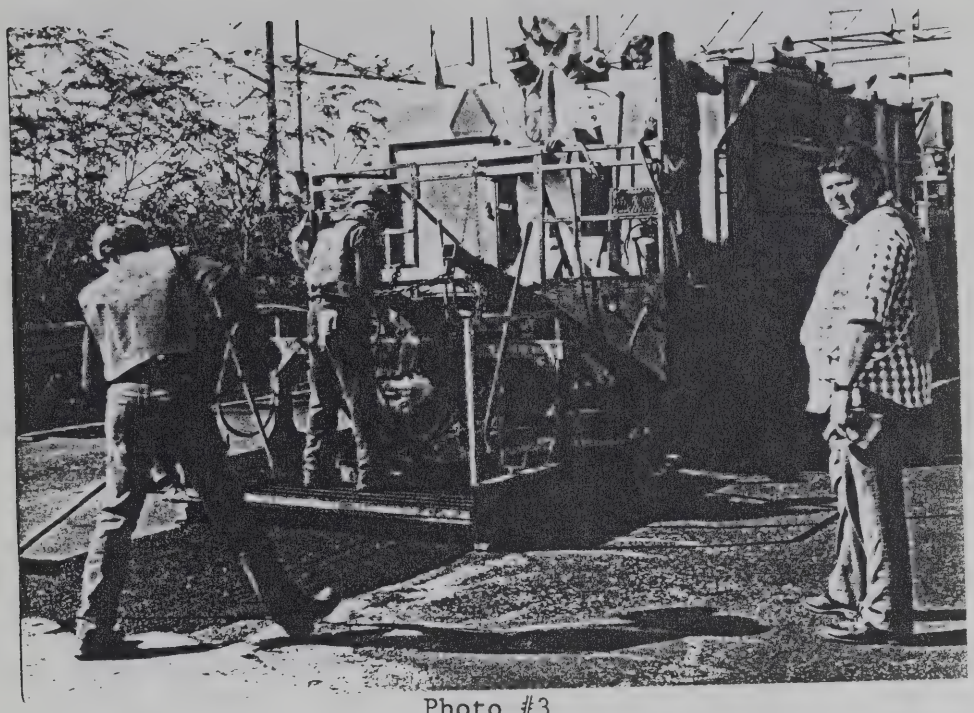


Photo #3

Rut Filling Operation

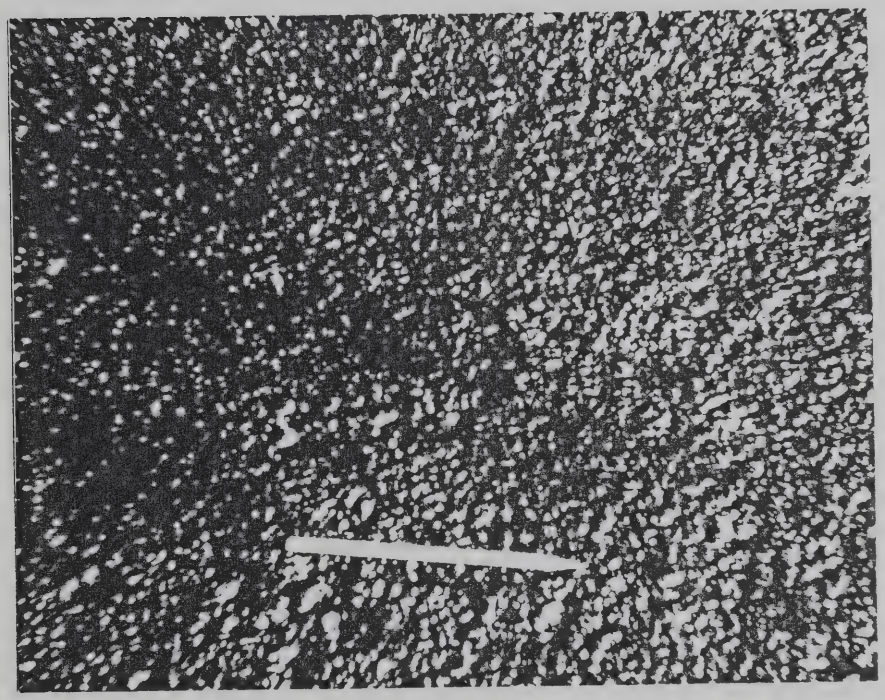


Photo #4

Inlay immediately after Paving

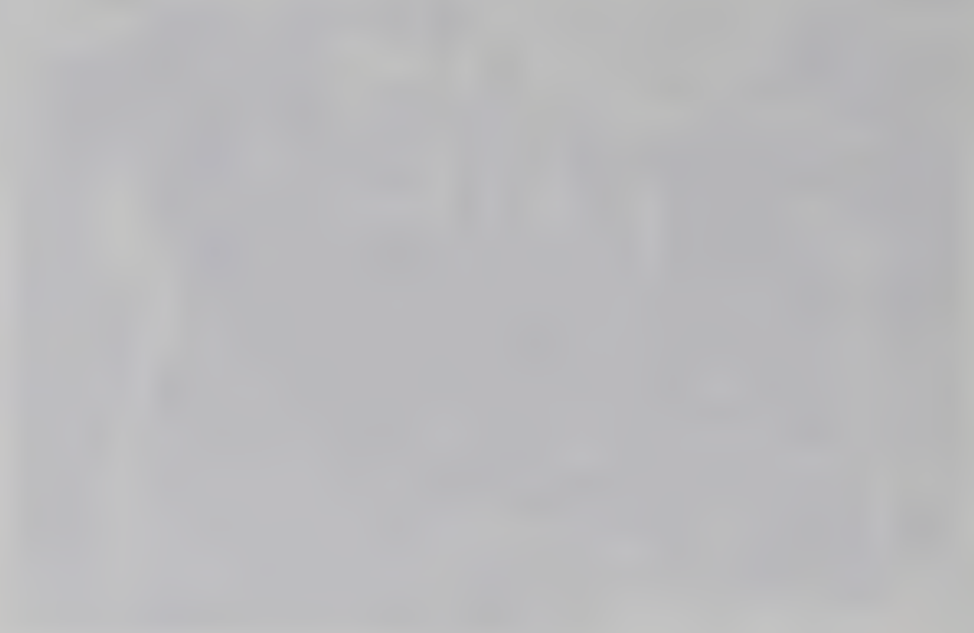
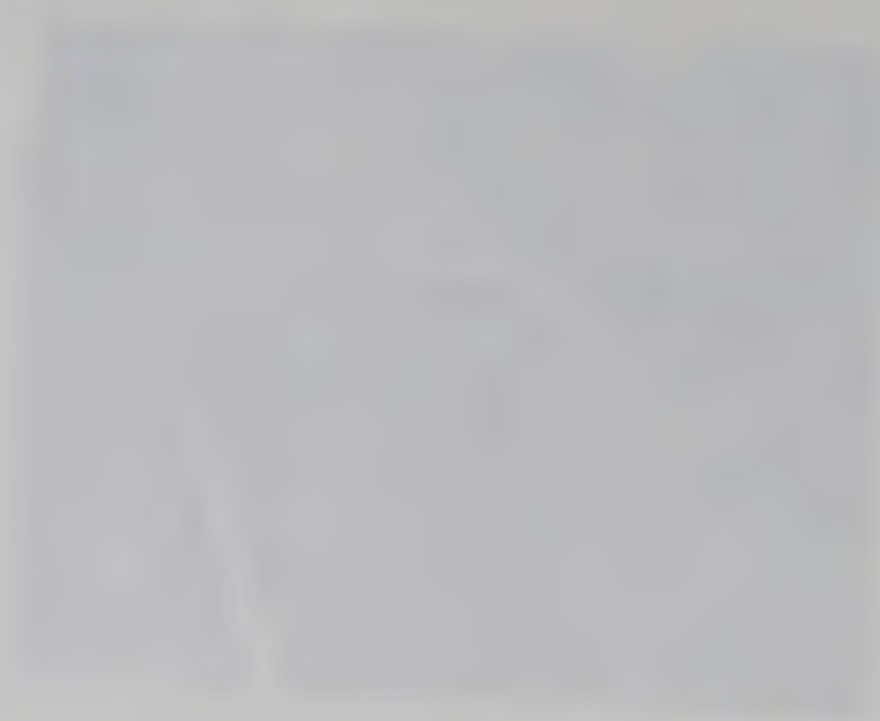


Photo #5

Finished Surface



contractor. On the day of the 6 hour curing time, the air temperature (64°F) was cool which delayed curing. The contractor delayed opening the section until curing was complete.

4.1 Data

Wheelpath rut depth data, skid resistance data, and May's data were taken before and after the construction. This data is shown in Table 2.

In the northbound lanes where the recent inlay was constructed, the rutting was 1-1/16 inch before construction and approximately 3/16 inch immediately after construction. This is a decrease in rutting of 85 percent. The 3/16 inch rutting after construction and subsequent 1/4 inch in December and 3/8 inch in July are attributed to the initial compaction by heavy trucks.

In the southbound lanes where the initial inlay was constructed and an overlay was applied, the rutting was 7/8 inch before the 1984 inlay construction. At the time of the overlay, the rutting was approximately 1/4 inch on the inlay. The overlay reduced the rutting to 3/16 inch. By July 1987, the rutting had increased to approximately 5/16 inch which is slightly less than the 3/8 inch in the northbound lane. It must be noted, however, that the southbound lanes have two separate applications of the inlay.

The initial average skid resistance values before the construction are 32.7 for the northbound and 35.6 for the southbound lane. The average skid resistance values after construction of the inlay and overlay in July 1986 increased to 47.0 in the northbound and 54.5 in the southbound. These increases are 43 percent and 53 percent respectively. These values are rated good. The latest average skid resistance values are 41.9 for the

Table 2

Rut Depths, Skid Resistance, Mays Data
Route I-295

Rut Depths	Northbound	Southbound
Before Inlay Construction 5/6/86	1.06 inches	0.22 inch (initial Ralumac)
Inlay 5/12/86	0.16 inch	0.16 inch (overlay)
Inlay 12/10/86	0.27 inch	0.28 inch (overlay)
Inlay 7/31/87	0.38 inch	0.30 inch (overlay)
Skid Resistance (SN)		
Before Inlay Const. (original Bit. Pavement)	Range 28-37 Avg. 32.7	Range 31-43 Avg. 35.6
Inlay 6/21/85	-	Range 38-48 Avg. 42.5
Inlay 10/7/85 (Initial Only)	-	Range 22-50 Avg. 38.0
Inlay 6/19/86	Range 43-52 Avg. 47.0	Range 45-64 Avg. 54.5 (overlay)
Inlay 6/25/87	Range 38-43 Avg. 40.5	Range 39-54 Avg. 47.9 (overlay)
Inlay 8/17/87	Range 37-45 Avg. 41.9	Range 48-60 Avg. 48.4
Mays Data		
Before Inlay Const. (No date)	2.02 PSR	2.09 PSR (Initial Ralumac)
After Inlay Construction 6/19/86	2.37 PSR	2.15 PSR (overlay)

northbound and 48.4 for the southbound. These values are also rated good, but are slightly less than the values immediately after construction. The lower values are probably due to the loss of texture which resulted from consolidation of the aggregate by heavy truck traffic. Since this project had no stopping areas, skid values were not available for those areas.

Mays roughness data were taken on the pavement before and after construction. The data are shown in Table 2 in the form of PSR values. Using Figure 3, the Mays roughness data were converted in the field to PSR, which is a simulated rating of the riders opinion of the pavement. This relationship was established in a 1986 New Jersey Department of Transportation study.

As a frame of reference for these values, a relationship between the proportion of raters that were dissatisfied with a pavement and the Mays roughness are shown in Figure 4. This figure shows that 50 percent of the raters were dissatisfied with the ride of pavement that has a PSR of 1.9. The PSR estimate of a typical new bituminous concrete overlay is 3.5. A comparison of the inlay 2.37 PSR and 2.15 PSR in Table 2 to the 1.9 PSR and 3.5 PSR of a new overlay indicates that these values are very low for new pavement and close to the 1.9 value. Since the primary purpose of the inlay was to correct a dangerously rutted pavement, the relatively low PSR values may be insignificant for the inlay. Ralumac, as with standard slurry seal treatments, is not meant to alter grade or alignment and would not be expected to significantly change the roughness characteristics of the surface.

Figure 3

Estimated PSR - Mays Relationships

1986 NJDOT Study

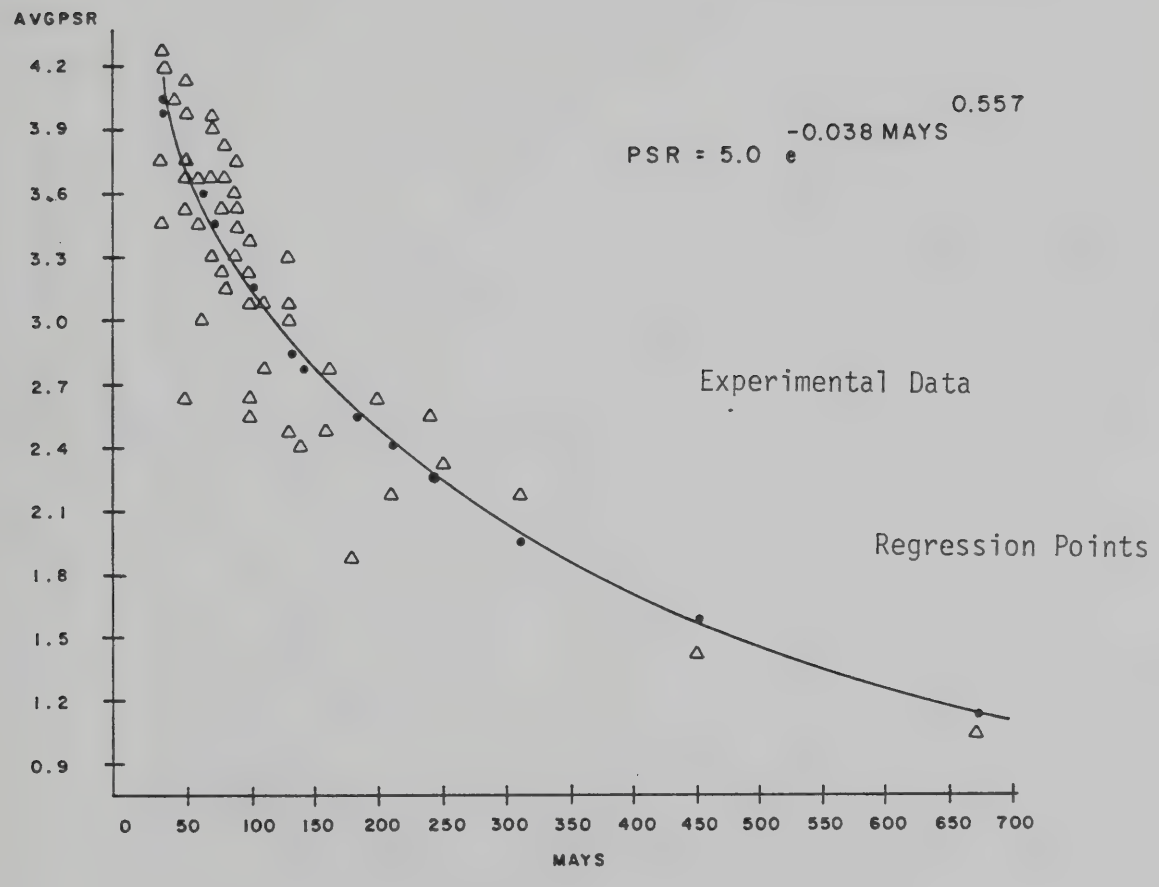
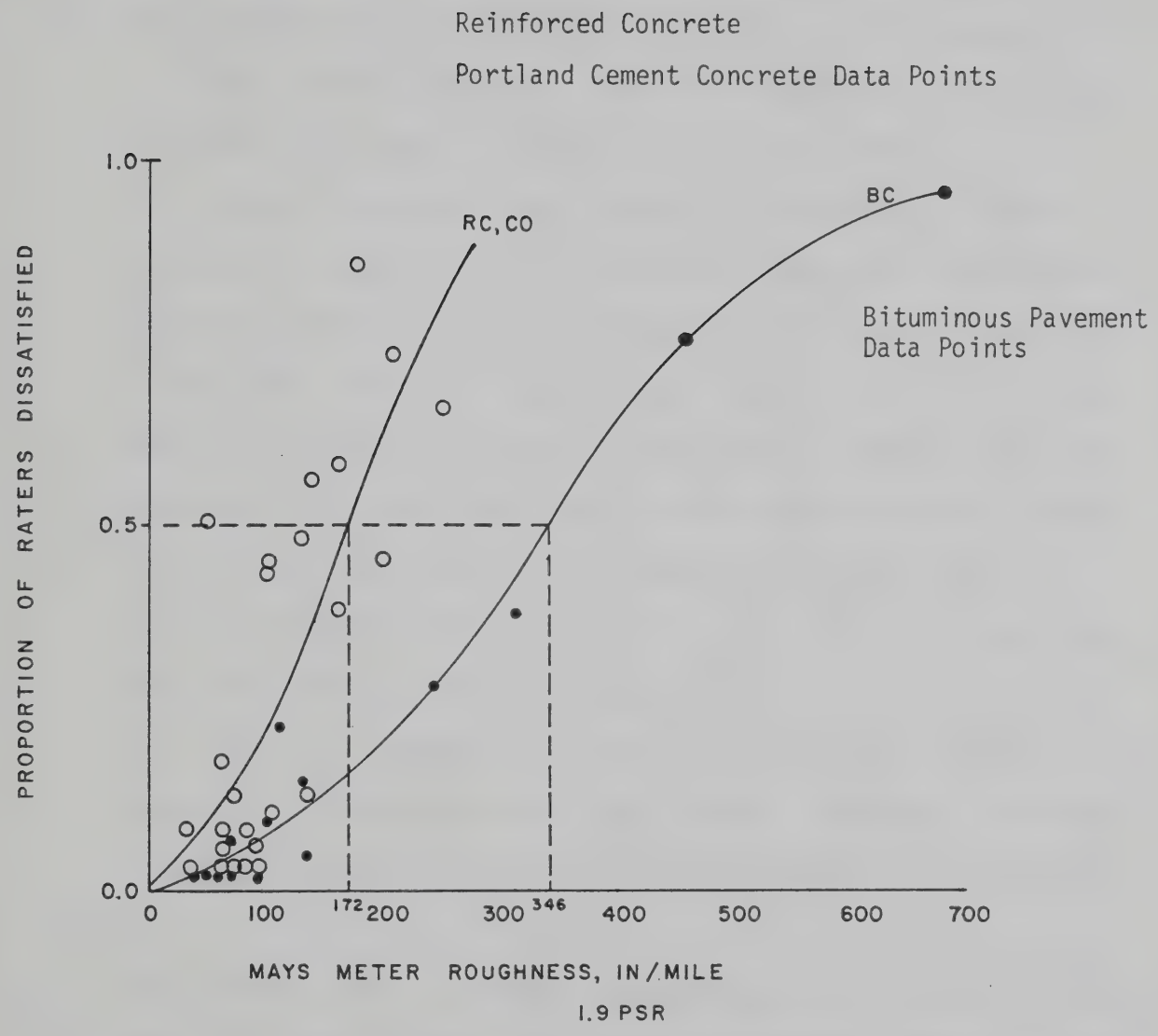


Figure 4

Estimated Logit Relationship, 1986 NJDOT STUDY



4.2 Construction Problems

Essentially, no major problems affected the quality of the construction. However, the following minor problems are discussed in this section.

1. The Ralumac paver was equipped with a 6 foot spreader box for filling ruts. This box which contains a power auger, broke down consistently and required hand labor to stir the material as it came from the pug mill. Removal of the front rubber screed from the first strike off plate resolved the problem.

2. On two occasions, large pieces of aggregate and chunks of bituminous pavement from the aggregate storage area contaminated the mix, which in turn were dragged by the screed causing drag marks and gouges in the surface. These pieces of foreign materials had to be removed by hand and the gouges had to be repaired. Two areas (600 feet) in the northbound center lane at M.P. 25 were repaved to correct gouges and poor texture.

3. On downhill grades, excess water and emulsion flowed from the front of the screed and spreader box.

4. After the pavement was open to traffic small amounts of aggregate ravelled from the riding surface. However, it was not a serious hazard to traffic and ceased after the second day.

4.3 Cost

The inplace cost of the 1986 inlay construction is $135 per ton, or about $3.16 square yard. This cost is undoubtedly affected by the experimental nature of the project and the out-of-state contractor. Lower costs would be anticipated with a greater volume of work and the availability of qualified local contractors.

However, the use of Ralumac as a rut filling procedure compares favorable with the cost of milling and overlaying. The present average cost of milling, including maintenance support, is $2.00 per square yard. The cost of a 1 1/2 inch bituminous overlay ranges from $2.50 to 3.50 per square yard. At this time, a pavement is not milled without overlaying. The average cost of milling and overlaying is about $5.00 per square yard as compared to the $3.16 per square yard for Ralumac. Obviously, the significance of these initial costs will have to await a determination of inlay life. At that time, life cycle cost comparisions can be made.

9/82

SUR-TECH, INC., Harrisburg, PA

MIX DESIGN FACT SHEET. RALUMAC PAVING SYSTEM

PROJECT NJ D.O.T. I 295 So. Bound MP. 23.8 to M.P. 26.0

Type Ralumac B Emulsion Man'f. Processed Asphalt Co

Mix Designed by Processed Asphalt Co Reading

Bituminous Technician(s) Andy Kock

Aggregate Sources
Stone 1-B Warner Co Dyer's Quarry Birdsboro Pa
Stone ½" NA Trap rock
#1 Screenings Warner Co Dyer's Quarry Birdsboro Pa
Dry Filler NA

% Passing Gradation Specification

Screen Size	Type A	B	RF
½	100	100	100
3/8	100	95-100	85-100
4	85-100	65-80	50-70
8	50-80	45-65	40-55
16	35-50	28-45	25-40
30	25-40	19-34	19-34
50	15-25	12-20	10-20
200	5-12	4-10	5-10

Actual Blending

Test Date 9-27-84

98.4
75.6
55.0
35.2
24.9
16.1
5.5

Marshall Design Data

Bit Binder	AC-20	Ralumac Latex Emulsion	Spec. Limits
Specific Gravity		2.519	
% Asphalt Content		6.72	
Stability		3480	1800 Min.
Flow		14.5	6 to 16
% Voids		3.4	NA
VMA		19.8	NA
VFA		82.9	NA

Mix Design Formulation 10.5 %Asphalt 2 %Cement 8 %H20 2 %Add.

COLD LAID LATEX MODIFIED EMULSION PAVEMENT COURSES

THE WORK TO BE PERFORMED AND THE MATERIALS TO BE SUPPLIED UNDER THIS CONTRACT SHALL COMPLY WITH THE CURRENT REQUIREMENTS OF THE NEW JERSEY DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION - 1983 EXCEPT AS AMENDED, MODIFIED OR SUPPLEMENTED HEREIN, AND WHICH STANDARD REQUIREMENTS ARE HEREBY MADE A PART OF THESE SUPPLEMENTARY SPECIFICATIONS.

1. Description

The location of this project is on Route I-295 S.B. from M.P. 23.8 to M.P. 26.0, and I-295 N.B. from M.P. 24.6 to M.P. 25.7, in West Deptford and Deptford Twps., Westville and Bellmawr Boroughs, in Gloucester and Camden Counties.

The work to be performed on this job is the construction of a Ralumac Paving System using a 6 foot rut box that fills ruts in the driving and middle lanes of Route I-295 S.B., from M.P. 23.8 to M.P. 24.4 in the middle lane and M.P. 23.8 to M.P. 24.9 in the slow lane, and Route I-295 N.B., from M.P. 24.6 to M.P. 25.7.

On Route I-295 S.B., from M.P. 23.8 to M.P. 26.0, the construction of a Ralumac Paving System using a paving box for full width overlay will be used to cap the entire three lanes with Ralumac.

2. Materials

(a) Bituminous Material: Latex Modified Emulsion Asphalt cationic Type CSS-1H conforming to ASSHTO. The emulsified asphalt will show no separation after mixing and conform to the requirements of Raschig Inc. for natural latex modified asphalt emulsion. Cement mixing test is waived for the latex modified CSS-1H Emulsified Asphalt.

(b) Mineral Aggregate: From currently accepted sources that the NJDOT uses for Top Course material, as specified in the Specifications.

(c) Mineral Filler: Use mineral filler of any approved non-air entrained portland cement Type 1, that is free of lumps.

(d) Water: Shall be potable and free from harmful soluble salts.

(e) Latex Modifier: A 100% natural latex based modifier along with emulsifiers milled into the asphalt emulsion by an approved emulsion manfacturer. Provide modifier capable of making emulsion mix cure sufficiently so normal traffic can be placed on the material in one hour without damaging the surface.

(f) Other Additives: Supplied by emulsion manufacturer to control mix set time.

(g) Mix Design: The manufacturer of the latex modified emulsion will develop the job mix formula and present certified test results for the Engineer's approval. Provide job mix formula for Types A, B or RF having a minimum Marshall stability of 1,500 pounds and flow of 6 to 16 units when tested according the ASTM D1559 modified procedures.The modifications is the air drying of the mix for three days before reheating and placement in test molds.

Use aggregate in job mix formula that represent material to be used on the project.

Mix Types

Type S — Used to seal cracks and fill voids or provide rich elastomer inner layer and tack prior to overlay.

Type A — Used to seal cracks, fill voids and shallow ruts and provide wearing surface;

Type B — Used to fill moderate ruts and give a heavier wearing surface;

Type RF — Used to fill deep ruts up to 2" in single pass.

(h) Proportioning: The Engineer will approve the design mix and all surfacing materials and methods prior to use and designate the proportions to be used within the following limits:

	Type S	Type A	Type B	Type RF
Surface Minimum Application Thickness Inches	N/A	1/4"	3/8"	N/A
Surfacing Mineral Aggregate lbs/sy dry wt.	10-20	18-30	25-50	50-70
Latex Emulsified Asphalt Residue by Wt. of Aggregates	7.0-8.0%	6.0-7.5%	5.5-7.0%	5.5-6.5%
Mineral Filler	2% ± 0.5 by weight of dry aggregate depending on weather conditions.			
Latex Based Modifier	As required	As required	As required	As required
Mix Set Additive	As required	As required	As required	As required

It is permissible to increase binder content for slags and other absorptive aggregates.

(i) Composition of Mixture: Provide aggregate and mineral filler within limits of Table A, asphalt emulsion, additive and water.

Table A
Composition by Weight Percentages
of Aggregate Gradations and Mineral Filler

Passing Sieve	Type S	Type A	Type B	Type RF
1/2"	100	100	100	100
3/8"	100	100	95-100	90-100
#4	90-100	85-100	65-85	55-75
#8	70-100	50-75	45-65	40-55
#16	45-80	40-65	28-45	25-40
#30	25-60	25-45	19-34	19-34
#50	15-40	13-25	10-20	10-20
#200	5-15	5-12	4-10	4-10

(j) Sampling and Testing: Take precautions to insure that stockpiles do not become contaminated. Screen oversize aggregate or foreign materials from the aggregate prior to delivery to the mixer. Sample the mixture daily or as directed, and analyze for binder content and compliance with specifications and submit certified results to engineer.

3. Construction

(a) Weather Limitations: Place when the atmospheric temperature is 40°F and rising or above, it is not raining and there is no forecast of temperatures below 32°F within 24 hours from the time the mixture is applied.

(b) Mixing Equipment: Produce the mixture in a self propelled front feed continous loading mixing machine equipped with chain draged conveyor belt aggregate delivery system and an inter-connected positive displacement water jacketed gear pump to accurately proportion ingredients. Provide a spray bar to completely wet the aggregate dropping down to pugmill with additive and water. Pug mill must be a continous flow, twin shafted multi blade and at least 60 inches long. The emulsion shall be introduced at least 25 inches up the mixer to insure proper mixing of aggregate, cement, additive and water before emulsion is added. Blade size and side clearances shall meet manufacturer's recommendations. Equip mixer with remote speed control at the back mixing platform so the back operator can control forward speed and level of mixture in paving or rutbox. Provide material control devices, readily accessible and so placed that the inspector may determine the amount of each material used at any time. Calibrate each material control device prior to each mix type application.

Equip machine with a water pressure system and nozzle type spray bar to provide a water spray ahead of and outside the spreader box when required.

Locate mineral filler feed so the proper amount of cement is dropped on the aggregate before discharge into mixer.

Truck mounted machine may be used on small projects of less than 15,000 s.y. or 150 ton.

(c) Spreading Equipment: Spread the mixture uniformly by means of a mechanical type squeegee box attached to the mixer, equipped with paddles mounted on adjustable shafts to continually agitate and distribute the materials throughout the box. Provide sufficient turbulance to prevent the mix from setting up in the box or causing excessive side build-up and lumps. Attach flexible seals, front and rear, in contact with the road, to prevent loss of mixture from the box. Rut filling equipment requires moveable steel strikeoff. Operate spreading equipment to prevent the loss of the mixture on super-elevated curves. Spread the mixture to fill cracks and minor surface irregularities and leave a uniform high-skid resistant application of aggregate and asphalt on the surface. Operate spreader box so a uniform consistency is achieved without causing skips, lumps or tears in the finished surface.

(d) Surface Preparation: Prior to applying mixture, clean the surface of vegetation, loose materials,dirt, mud and other objectionable items. Crack filling and sealing will be performed by NJDOT forces. Apply water to the surface at a rate to dampen entire surface immediately prior to applying mixture.

(e) Application: Spread the mixture to fill minor cracks and shallow potholes and leave a uniform surface. Take care when rut filling to restore the designed profile of the pavement cross section. Aviod excess crowning (over filling) of rut areas. Use squeegees and lutes to spread the mixture in areas inaccessible to the spreader box and areas requiring hand spreading.

Carry a sufficient amount of material, at all times, in all parts of the spreader box so complete coverage is obtained. Water may be sprayed into spreader box to facilitate spreading without harming the mix. No lumping, balling or unmixed aggregate is permitted in the finished surface.

Adjustments to the additive may be required for slow setting where hand spreading is needed. When hand spreading, pour the mixture in small windrow along one edge of the surface to be covered and then spread uniformly by a hand squeegee or lute.

Make a neat appearing seam where two passes join. Remove excess material from ends of each run immediately.

(f) Compaction: Rolling will be required for Type A, B or RF mixtures. Roll with pneumatic-tired roller as specified in NJDOT Specifications equipped with treaded tires with tire pressure of 40-60 psi.

(g) Traffic Control: The Safety and Traffic Control will be provided for by the Contractor.

Throughout the Project, thru traffic on Route I-295 shall be maintained in its normal pattern except as may be necessary while the work is actually in progress. At this time construction phasing of this project shall be carried out in accordance with the Traffic Control Plans and as directed by the Resident Engineer.

Direction of travel shall be regulated by competent uniform traffic directors. At no time will a traffic lane have an unobstructed width of less than 11 feet.

Traffic Stripes shall be constructed on the newly paved surface before the end of the work shift or as directed by the Resident Engineer. When filling the ruts on the Northbound direction and when completing the Southbound, the traffic stripes should not be covered, and remain visible at all times. If this cannot be achieved, then new traffic stripes will be constructed before the end of the work shift. Traffic access and engress shall be maintained at all times at ramp areas located within the work area.

Any reduction of the number of lanes available for traffic or any constriction of existing widths of traveled way permitted by the Plans or Specifications or approved by the Engineer will not be permitted until after 9:00 a.m. and shall be completely removed prior to 4:00 p.m., or as directed by the Resident Engineer.

The Contractor will be allowed to work on Saturdays, conforming to starting and ending times as directed by the Resident Engineer.

All Traffic Control Devices will conform to the Manual on Uniform Traffic Control Devices, and be erected as designated on the Traffic Control Plans.

Payment for Maintenance of Traffic will be made on a lump sum basis.

4. Measurement and Payment

(a) Materials Used Basis - Ton

1. Aggregate: The quantity of aggregate used in the accepted portions of work will be measured by net weight of individual loads of aggregate shipped to the job and incorporated into accepted work. Deduction will be made for moisture naturally occuring in the aggregate. The weight of mineral filler will be included and this quantity will be computed from a count of cement sacks used. The combined weight will be the pay quantity for Aggregate.

2. Latex Modified Asphalt Emulsion: The quantity of Latex Modified Asphalt Emulsion used in the accepted portion of the work will be measured by weight of emulsion shipped and used. This will be the pay quantity for Latex Modified Emulsified Asphalt.

(b) Area Basis - Square Yard

This work will be measured on the surface using the two dimensional method and include all areas shown on the drawings or otherwise approved by the Engineer.

LB-9 1/84

NEW JERSEY DEPARTMENT OF TRANSPORTATION
Trenton, New Jersey

SERIAL NO. 413157

REPORT OF ANALYSIS OF AGGREGATE

APPENDIX C

RGED TO: Route 295, Maint. Contract, Ralumac Paving System

POSED USE Ralumac Paving System

D OF MATERIAL Blended Sand & Stone | SIZE OR DESIGNATION

DUCER Mt. Holly Asphalt | LOCATION Mt. Holly, NJ

NT | LOCATION

REPORTED TO: Louis Sansone

PLE TAKEN FROM	Stockpile				
NTITY REPRESENTED					
KS ON SAMPLE	ENGC. STAFF #9				
PLED BY	Rodigilio T. Sauter				
E TAKEN	May 8, 1986				
E REC'D. AT LAB.	May 12, 1986				
L NO.	0470614				
SERIAL NO.	413157				
E OF OPENING	TOTAL PERCENT PASSING			REQUIRED	
ARE				Min.	Max.
4"					
3 ½"					
3"					
2 ½"					
2"					
1 ½"					
1"					
¾"					
½"	100			100	
3/8"	98			95	100
No. 4	86 *			65	85
No. 8	60			45	65
No. 16	42			28	45
No. 30	30			19	34
No. 50	21 *			10	20
No. 100	15				
No. 200	10			4	10
STICITY INDEX					
ORPTION					
IUM SULFATE LOSS					

MARKS:

Fails to comply with gradation specification.

*Subsequently, modified by contractor to meet specification.

P. Marchetti

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New Jersey Department of Transportation

ANALYSIS OF MISCELLANEOUS MATERIALS

5/24/86

Serial No. 413153

d To: Rt. 295, Maint. Contract, Ralumac Paving System

f Material Lates Modified Emulsion Asphalt

ed Use Ralumac Paving System

er PACO Location: Reading, PA.

Location:

e Taken From	Mixing equipment			REPORTED TO
y Represented				
on Sample	Engg. Staff # 10			
d By	R. Santos			
Specified	Cationic Type CSS-1H			
. Shipped From				
ed on Inspector's Daily Report No.				
aken	5/8/86			Louis Sansone
eceived at Laboratory	5/12/86			
umber	0470615			
ory Serial No.	413153			
TESTS	ANALYSES		REQUIRED MIN.	MAX.
icle Charge	Positive			
osity at 77°F	59			
% Residue	58			
s on Residue:				
nerat at 77°F	72			
lubility %	99.7			

RKS:

REJ/bw Original Signed R. E. Joiner